USPS-T-25

BEFORE THE
POSTAL RATE COMMISSION
WASHINGTON, D.C. 20268-0001

POSTAL RATE AND FEE CHANGES, 2000

Docket No. R2000-1

# DIRECT TESTIMONY
# OF
# DAVID G. YACOBUCCI
# ON BEHALF OF
# UNITED STATES POSTAL SERVICE

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# DIRECT TESTIMONY OF DAVID G. YACOBUCCI

## AUTOBIOGRAPHICAL SKETCH

My name is David G. Yacobucci. I have worked for the Postal Service since 1997 as an Economist in the Special Studies office. Prior to joining the Postal Service, I worked as a consultant at Price Waterhouse. At Price Waterhouse, my responsibilities included directing and performing management consulting services based upon quantitative techniques. Such techniques included survey and sample design, linear programming, forecasting, regression, data mining, and data warehousing.

At the Postal Service, I have visited field offices including air mail facilities, bulk mail centers, processing and distribution centers, and delivery units. I observed transportation, mail processing, and delivery operations during these visits.

I earned Master of Engineering and Bachelor of Science degrees in Operations Research and Industrial Engineering from Cornell University in 1993 and 1992, respectively.

## I. PURPOSE AND SCOPE OF TESTIMONY

The purpose of my testimony is to compute test year (TY) unit volume variable mail processing costs for flat-shaped mail. This testimony uses these costs to calculate weighted-average mail processing costs by rate category and to calculate isolated barcode-related cost savings.

To develop these costs and savings, the testimony models distinct mailflows for combinations of container presortation, bundle presortation, barcoding, and piece machinability.[1] These costs support the presort and automation discounts proposed by witnesses Fronk (USPS-T-33), Taufique (USPS-T-38), and Moeller (USPS-T-35) for First-Class, Periodicals Regular, Periodicals Nonprofit, Standard Mail (A) Regular, and Standard Mail (A) Nonprofit flats.

[1] This testimony uses the following terms interchangeably: "bundle" and "package," "barcoded" and "automation," and "nonbarcoded" and "nonautomation."

## II. SUMMARY OF RESULTS

This testimony uses unit volume variable mail processing costs to calculate "*cost averages-actual*" and "*cost averages-normalized auto-related savings*" for flat-shaped mail. *Cost averages-actual* are weighted-average mail processing costs by rate category. Subtracting one weighted-average cost from another when holding automation/nonautomation characteristics constant yields presortation-related mail processing cost differences. *Cost averages-normalized auto-related savings* are normalized weighted-average mail processing costs that isolate barcode-related savings. The differences of these cost averages when holding the presort category constant are the isolated barcode-related savings. Sections V and VI of this testimony discuss each method in greater detail.

Tables II-1 through II-5 present the results provided for pricing purposes.

**TABLE II-1: FIRST-CLASS**
**UNIT VOLUME VARIABLE MAIL PROCESSING COSTS**

| Method | Rate Category | Cost (cents) |
|---|---|---|
| Cost Averages-Actual | | |
| | Basic, Nonautomation | 40.594 |
| | Basic, Automation | 47.754 |
| | 3-Digit, Automation | 43.872 |
| | 5-Digit, Automation | 30.006 |
| Cost Averages-Normalized Auto-Related Savings | | |
| | Basic, Nonautomation | 55.041 |
| | Basic, Automation | 49.940 |
| | 3-Digit, Automation | 40.659 |
| | 5-Digit, Automation | 30.036 |

**TABLE II-2: PERIODICALS REGULAR**
**UNIT VOLUME VARIABLE MAIL PROCESSING COSTS**

| Method | Rate Category | Cost (cents) |
|---|---|---|
| Cost Averages-Actual | | |
| | Basic, Nonautomation | 22.781 |
| | Basic, Automation | 21.493 |
| | 3-Digit, Nonautomation | 18.332 |
| | 3-Digit, Automation | 17.898 |
| | 5-Digit, Nonautomation | 13.133 |
| | 5-Digit, Automation | 13.572 |
| | Carrier Route | 8.640 |
| Cost Averages-Normalized Auto-Related Savings | | |
| | Basic, Nonautomation | 24.115 |
| | Basic, Automation | 21.992 |
| | 3-Digit, Nonautomation | 19.269 |
| | 3-Digit, Automation | 17.755 |
| | 5-Digit, Nonautomation | 13.720 |
| | 5-Digit, Automation | 13.465 |

**TABLE II-3: PERIODICALS NONPROFIT**
**UNIT VOLUME VARIABLE MAIL PROCESSING COSTS**

| Method | Rate Category | Cost (cents) |
|---|---|---|
| Cost Averages-Actual | | |
| | Basic, Nonautomation | 14.157 |
| | Basic, Automation | 11.989 |
| | 3-Digit, Nonautomation | 11.438 |
| | 3-Digit, Automation | 10.523 |
| | 5-Digit, Nonautomation | 7.956 |
| | 5-Digit, Automation | 8.039 |
| | Carrier Route | 5.008 |
| Cost Averages-Normalized Auto-Related Savings | | |
| | Basic, Nonautomation | 14.399 |
| | Basic, Automation | 13.092 |
| | 3-Digit, Nonautomation | 11.733 |
| | 3-Digit, Automation | 10.694 |
| | 5-Digit, Nonautomation | 8.141 |
| | 5-Digit, Automation | 7.958 |

**TABLE II-4: STANDARD MAIL (A) REGULAR**
**UNIT VOLUME VARIABLE MAIL PROCESSING COSTS**

| Method | Rate Category | Cost (cents) |
|---|---|---|
| Cost Averages-Actual | | |
| | Basic, Nonautomation | 17.765 |
| | Basic, Automation | 17.459 |
| | 3/5-Digit, Nonautomation | 12.152 |
| | 3/5-Digit, Automation | 11.664 |
| Cost Averages-Normalized Auto-Related Savings | | |
| | Basic, Nonautomation | 19.825 |
| | Basic, Automation | 17.915 |
| | 3/5-Digit, Nonautomation | 12.004 |
| | 3/5-Digit, Automation | 11.457 |

**TABLE II-5: STANDARD MAIL (A) NONPROFIT**
**UNIT VOLUME VARIABLE MAIL PROCESSING COSTS**

| Method | Rate Category | Cost (cents) |
|---|---|---|
| Cost Averages-Actual | | |
| | Basic, Nonautomation | 17.009 |
| | Basic, Automation | 17.016 |
| | 3/5-Digit, Nonautomation | 10.098 |
| | 3/5-Digit, Automation | 11.528 |
| Cost Averages-Normalized Auto-Related Savings | | |
| | Basic, Nonautomation | 19.334 |
| | Basic, Automation | 17.487 |
| | 3/5-Digit, Nonautomation | 10.848 |
| | 3/5-Digit, Automation | 10.370 |

## III. SUPPORTING MATERIALS

This section briefly discusses the supporting materials that are associated with this testimony.

### A. USPS LR-I-90, FLATS MAIL PROCESSING COST MODEL.

Library reference USPS LR-I-90 presents the electronic spreadsheet that this testimony used to develop the unit volume variable costs presented in section II. The spreadsheet presents the data inputs, performs the cost calculations, and specifies citations and notes.

A review of the structure and of section IV, part H, provides a better understanding of the model. Due to the size of the model's printouts, LR-I-90 only presents the electronic version and selected worksheet printouts.

### B. USPS LR-I-87, PERIODICALS MAIL CHARACTERISTICS SURVEY

Library reference USPS LR-I-87 presents the Periodicals Regular and Nonprofit mail characteristics survey. This survey provides information on mail make-up and preparation of flat-shaped Periodicals. The flats mail processing cost model uses these data to determine volume-based weights in order to calculate weighted-average costs and weighted-average barcode-related savings.

Data come from electronic manifests of Periodicals mailings and from a national survey of Periodicals mailings sampled through Bulk Mail Entry Units and Detached Mail Units for randomly selected finance numbers. The survey collected data from June 1999 to July 1999.

### C. USPS LR-I-89, COVERAGE FACTORS FOR FLATS.

Library reference USPS LR-I-89 presents the coverage factor analysis. This analysis allocates originating and destinating volumes to facilities that employ specific flat sorting machines. The results are the percentages of mail volume

that originate or destinate to facilities that have equipment. The flats mail processing cost model uses these data to model the mail flow of flats.

D. USPS LR-I-88, FLATS BUNDLE STUDY.

Library reference USPS LR-I-88 presents the bundle study. This study collected and analyzed data pertaining to bundle handling activities. Study results included mechanized sorting productivities, manual sorting productivities, downflow densities, and percentages of mechanized and manual handlings. The flats mail processing cost model uses these data to calculate unit volume variable mail processing costs. The study collected data between September 1998 and December 1998.

## IV. COST DEVELOPMENT

### A. OVERVIEW

This testimony develops unit volume variable mail processing costs for flats based on particular cost-driving characteristics. This testimony refers to these characteristics as worksharing attributes and elements and discusses them below. It develops the costs by modeling flats' mailflows across prospective bundle and piece distribution activities. These activities represent TY 2001 mail processing operations for flats. Witness Kingsley discusses these operations in USPS-T-10.

The analysis combines the costs using volume-based weights to develop costs by rate category. The analysis also isolates barcode-related cost savings, holding all other factors constant.

The barcode-related cost savings are the mail processing cost differences of flats with barcodes and those same flats without barcodes. The net results are the mail processing costs avoided due to the barcode.

### B. METHODOLOGY

This testimony employs the following methodological approach using Microsoft Excel 97 software. The general methodology is based upon witness Seckar's methodology in Docket No. R97-1, USPS-T-26 and USPS LR-H-134.

This approach considers mail processing differences due to variable worksharing elements in developing costs. Mail processing differences include differences in productivities, downflow densities, and coverage factors. For example, this approach assumes that the barcoded worksharing element is an activity that influences mail processing and, hence, mail processing costs. For a barcoded piece, the worksharing-related savings reflect mail processing differences

between a barcoded flat and a nonbarcoded flat, holding all other worksharing elements constant.

For the first step of this approach, I identified the following worksharing attributes that cause flats to either avoid or incur mail processing activity costs and for which sufficient modeling data exist:

- Barcoding
- Bundle Presortation
- Container Presortation
- Piece Machinability

I did not include Container Type[2] as a worksharing attribute due to the lack of necessary and sufficient modeling data. Such data include container breakdown productivities, the type of container breakdowns, and the frequency of container breakdowns by container type.

For the second step, I identified the following elements of the worksharing attributes:

- Barcoding Attribute: Barcoded or Nonbarcoded
- Bundle Presortation Attribute: Carrier Route[3], 5-Digit, 3-Digit, Area Distribution Center (ADC), or Mixed Area Distribution Center (MADC)
- Container Presortation Attribute: Carrier Route[3], 5-Digit, 3-Digit, ADC, or MADC[4]
- Piece Machinability Attribute: Machinable or Nonmachinable[5]

[2] Sacks and pallets are examples of container types.
[3] For Periodicals only.
[4] This testimony combined Sectional Center Facility (SCF) containers with 3-Digit containers.
[5] I defined machinable flats as flats eligible for Flat Sorting Machine 881 (FSM 881) and Automated Flat Sorting Machine 100 (AFSM 100) processing. Such

For the third step, I identified the following mail processing activities that vary with respect to the elements of the worksharing attributes:

- Bundle Sortation: MADC Container, ADC Container, 3D Container, or 5D Container
- FSM 881 BCR/OCR Sortation: Outgoing Primary (OP)[6], ADC, Incoming Primary (IP), or Incoming Secondary (IS)
- FSM 881 Keying Sortation: OP, ADC, IP, or IS
- AFSM 100 BCR/OCR/VCS[7] Sortation: OP, ADC, IP, or IS
- FSM 1000 BCR Sortation: OP, ADC, IP, or IS
- FSM 1000 Keying Sortation: OP, ADC, IP, or IS
- Manual Sortation: OP, ADC, IP, or IS

For the fourth step, I developed the modeled unit volume variable cost of each appropriate combination of elements by modeling the distinct mailflows across the mail processing activities. For First-Class Mail, Standard Mail (A) Regular, and Standard Mail (A) Nonprofit, I modeled 40 distinct mailflows. For Periodicals Regular and Periodicals Nonprofit, I modeled 47 distinct mailflows.

For the fifth step, I adjusted the modeled unit volume variable cost using worksharing-related and not worksharing-related Cost and Revenue Analysis (CRA) costs.

For the sixth step, I weighted the CRA-adjusted unit volume variable costs using volumes to develop weighted-average costs by rate category.

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pieces meet the FSM 881 processing criteria in DMM § C820. Nonmachinable flats are all other flats and are eligible for FSM 1000 processing.

[6] The analysis combined OP with Outgoing Secondary (OS) activities. In addition, it combined Sectional Center Facility (SCF) with IP activities.

[7] VCS is an acronym for Video Coding System.

For the seventh step, I weighted the CRA-adjusted unit volume variable costs using volumes to develop normalized weighted-average costs that isolate barcode-related savings.

## C. ENHANCEMENTS

This testimony makes the following enhancements to witness Seckar's model methodology and construct in Docket No. R97-1, USPS-T-26.

### 1. Updated Mail Processing Activities

The model incorporates updated mail processing activities that include AFSM 100 deployments, FSM 881 OCR retrofits, and FSM 1000 BCR retrofits.

### 2. Integrated Bundle and Piece Handling Model

The model integrates the bundle and piece handling components into one model. Bundles enter bundle handling activities and subsequently flow as bundles to downstream bundle handling activities or separately as pieces to piece handling activities.

### 3. Updated Bundle Handling Model

The model incorporates an updated bundle handling model. Container presortation determines which modeled bundle handling activity bundles enter. Then, bundles flow to downstream bundle handling activities based on bundle downflow densities or to piece distribution.

The model uses data that include bundle handling productivities, number of bundle handlings, and piggyback factors to develop modeled bundle distribution costs per piece.

4. Updated Periodicals Carrier Route Costing Methodology

The model develops mail processing costs for carrier route-presorted Periodicals using an updated methodology. The model flows carrier route bundles across bundle handling activities and, when bundles inadvertently break, flows separate carrier route pieces across piece handling activities. For carrier route containers, the model flows bundles directly to a container opening activity. The model assigns costs based on the number of handlings per activity and data that include bundle productivities, wage rates, and piggyback factors.

This updated approach is similar to witness Seckar's approach in Docket No. R97-1, USPS-T-26 and USPS LR-H-134 which originated in Docket No. R90-1, Exhibit USPS-9G. For carrier route containers, this past approach incorporated container opening costs. For non-carrier route containers, this past approach incorporated allied labor costs to open and dump the container and bundle sortation costs. The current approach incorporates such costs but, unlike the past approach, models carrier route mailflows across bundle and piece handling activities.

5. Incorporated Bundle Breakage

The model incorporates inadvertent bundle breakage into the modeled mail flow. The model assigns a bundle handling cost to the broken bundle and subsequently flows the pieces to the piece distribution *scheme* comparable to the bundle handling *scheme* in which the bundle broke.

6. Incorporated Capacity/SOP

The model incorporates equipment capacity and standard operating procedure (SOP) factors to reflect operational capacity and SOP constraints. Flats that are eligible for and have access to a specific piece distribution activity will flow to other activities due to capacity or SOP constraints.

7. Enhanced Costing By Worksharing Attribute and Element Combinations

The model develops costs for each worksharing attribute and element combination. This isolates mail processing costs that enable enhanced worksharing-related savings analyses.

8. Updated Input Data

The model incorporates updated input data. Such data include coverage factors, productivities, accept rates, mail characteristics volumes, and CRA costs.

## D. MAILFLOW MODEL DESIGN

The mailflow model design integrates bundle and piece handling activities to represent mail processing of flats for costing purposes. Data determine how the model flows flats across activities. Such data include coverage factors, capacity/SOP factors, reject rates, and downflow densities. The modeled cost analysis uses the number of bundle or piece handlings per activity to determine the modeled unit volume variable cost.

## E. VOLUMES

The model determines volume shares for each modeled worksharing element combination as percentages of total volume. The model combines historical data from mail characteristics surveys and from billing determinants to calculate the volume shares. The model uses historical volumes in lieu of forecasted volumes to be consistent with witness Smith's (USPS-T-21) analysis of mail processing costs by shape. Witness Smith assumes volume shares are constant when moving from the base to test year.

## F. CRA-ADJUSTED COSTS

The model adjusts the modeled unit volume variable costs to determine CRA-adjusted unit volume variable costs. This is to allocate all modeled and non-modeled volume variable mail processing costs and to reconcile variation inherent in any model. Modeled costs include bundle handling, bundle opening, and piece handling costs. Non-modeled costs include platform and cancellation costs.

CRA costs are mail processing costs divided into cost pools. The model considers each cost pool's cost as either worksharing-related or not worksharing-related. Worksharing-related costs are costs that are variable with respect to worksharing activity. Not worksharing-related costs are costs that are not variable with respect to worksharing activity.

The model determines a proportional CRA adjustment factor by dividing the worksharing-related CRA cost by the weighted average modeled unit volume variable cost. The model adjusts the modeled unit volume variable costs by multiplying each by the proportional CRA adjustment factor and then by adding the not worksharing-related CRA cost to the consequent product. Hence, the resulting CRA-adjusted unit volume variable costs are "deaveraged" CRA costs that reflect modeled worksharing cost relationships.

## G. MODEL INPUTS

The following list describes data inputs to the model. LR-I-90 cites sources for the data inputs.

1. Labor Rate

The labor rate is the average cost per hour for clerks and mailhandlers involved in processing flats. Hence, this labor rate excludes window service and remote encoding center clerks' wages.

2. Premium Pay Factors

Premium pay reflects the marginal cost difference due to service standards between First-Class, Periodicals, and Standard Mail (A) mail. Differences in the amount of night and Sunday premium pay hours incurred for mail processing cause the factors to differ.

3. Piggyback Factors

Activity-specific piggyback factors determine activity-specific indirect mail processing costs. Indirect mail processing costs include such cost elements as supervisors, rent, custodial, heat, lighting, facility and equipment-related maintenance, and equipment depreciation.

4. Number of Bundle Handlings

The number of bundle handlings is the average number of handlings a bundle receives within each bundle handling activity.

5. Percentage of Bundle Handlings

The percentage of bundle handlings is the percentage of mechanized versus manual bundle handlings. The model uses one set of percentages for bundles in MADC, ADC, and 3D containers and another set for bundles in 5D containers. This division is due to materially different percentages of mechanized and manual bundle handlings for bundles in 5D containers than for bundles in all other containers. The model uses one set of percentages for bundles in MADC, ADC, and 3D containers due to model simplification and materially similar percentages.

The model uses these data to weight mechanized and manual bundle productivities to develop mean bundle handling productivities for each bundle handling activity.

6. Bundle Breakage

Bundle breakage is the percentage of bundles that prematurely lose bundle integrity and bundle presortation. The model assigns a bundle handling cost to the broken bundle and flows the pieces in the former bundle to the piece distribution *scheme* comparable to the bundle handling *scheme* in which the bundle broke.

7. Pieces per Bundle

Pieces per bundle is the average number of flats per bundle. The model uses the data to determine the number of bundles entering bundle distribution.

8. IS Machine/Manual Factors

Incoming secondary machine/manual factors are the percentages of flats by machine type that flow to a machine for incoming secondary piece handlings that the machine actually processes. The remaining flats not actually processed on the machine are processed manually.

9. Plant/Delivery Unit Manual IS Factor

The plant/delivery unit manual incoming secondary factor is the percentage of flats within manual incoming secondary piece distribution operations that the plant actually distributes. The remaining flats not actually distributed through the manual incoming secondary piece distribution operations at the plant are processed manually in the delivery unit.

The application of IS machine/manual factors and the plant/delivery unit manual IS factor model the practice of plants performing IS distribution for larger zones and the delivery unit performing IS distribution for smaller zones.

10. Coverage Factors

Coverage factors are the percentages of mail volume that originate or destinate to facilities that have flat sorting machines. That is, coverage factors are the proportions of mail volume that have access to equipment.

11. Capacity/SOP Factors

These factors indicate the piece distribution activities to which flats volumes flow due to capacity or standard operating procedure constraints. The flats volumes must be eligible for and have access to the specific piece distribution activity. In other words, these factors allocate flats to specific piece distribution activities. Operations estimated these factors.

For example, the model considers barcoded, machinable Periodicals flats to be eligible for AFSM 100 and FSM 881 processing. Assume in this example that those flats originate in a facility that employs AFSM 100s and FSM 881s. The originating AFSM 100 barcoded capacity/SOP factors for Periodicals direct the model to allocate 55 percent and 45 percent of the flats to the AFSM 100 and FSM 881 respectively.[8] Then, the originating FSM 881 barcoded capacity/SOP factors for Periodicals direct the model to allocate 100 percent of the 45 percent to the FSM 881. This results in 55 out of 100 flats modeled on the AFSM 100 activity and 45 out of 100 flats modeled on the FSM 881 activity. This allocation considers standard operating procedures and finite machine capacity.

The modeling approach developed and applied the capacity/SOP factors independently of the IS machine/manual factors and the plant/delivery unit manual IS factor. In developing the destinating capacity/SOP factors, the testimony considered IP piece distribution only. Including IS piece distribution will overstate the number of flats allocated to manual piece distribution activities

[8] USPS LR-I-90, '*CapacitySOP*' Factors Worksheet.

when the model applies both the capacity/SOP and IS machine/manual factors. IS machine/manual factors allocate flats to IS manual piece distribution activities.

12. Downflow Densities

Bundle downflow densities are the percentages of bundles that flow from one bundle handling activity to a downstream bundle handling activity or to piece distribution. The model presents bundle downflow densities by container presortation by bundle presortation.

Piece downflow densities are the percentages of flats that flow from one sortation scheme to a downstream sortation scheme. Flats that require a second sort on the same equipment using the same sortation scheme are considered to "flow to itself."

The model uses the piece downflow density "flow to itself" to inflate the number of handlings per piece in the *'Mailflow Model Costs'* worksheet.

13. Productivities

Bundle handling and piece distribution productivities are the respective number of bundles and pieces processed per work hour.

14. Volume Variability Factors

Volume variability factors are the elasticities of cost with respect to volumes for mail processing activities. The factors represent the percentage changes in cost divided by the percentage changes in volume.

The model uses volume variability factors to develop marginal productivities.

15. Accept Rates

Bundle and piece accept rates are the respective percentages of bundle volumes and piece volumes successfully sorted by an activity. The model presents

bundle accept rates by outgoing and incoming. The model presents piece accept rates by piece distribution activity by piece distribution scheme.

The model uses the bundle reject rates, that is, the difference of one less the bundle accept rates, to inflate the number of handlings per bundle in the *'Mailflow Model Costs'* worksheet. The model uses the piece reject rates, that is, the difference of one less the piece accept rates, to flow rejected flats to the appropriate processing activity.

16. CRA Costs

CRA costs are mail processing costs divided into cost pools. The model classifies each cost pool's cost as either worksharing-related or not worksharing-related. Worksharing-related costs are costs that are variable with respect to modeled worksharing activity. Not worksharing-related costs are costs that are not variable with respect to modeled worksharing activity.

17. Volumes

Volumes are the number of pieces for each worksharing element combination. The model uses the resulting volume percentages as weights in calculating weighted-average costs and weighted-average barcode-related savings.

## H. MODEL WORKSHEETS

The following list describes each worksheet of the Excel model. LR-I-90 presents the model and worksheets.

1. *'Control Sheet'* Worksheet

This worksheet controls the model. The user selects or enters scenario information to develop scenario costs. A scenario is a distinct combination of worksharing elements. Variable inputs located in cells B2 through B7 correspond

to the scenario's mail class, mail subclass, volume variability assumption, number of entry pieces, and number.

This worksheet houses two macro buttons: '*Run All Scenarios*' and '*RUN All Scenarios – PRINT "Mailflow Model" & "Mailflow Model Costs" Worksheets.*' When pressed, the former button executes a macro that models the pertinent scenarios for the desired class, subclass, and volume variability assumption. The macro also copies each scenario's total modeled costs per piece to the *'Scenario Costs'* worksheet.

When pressed, the latter button executes a macro that performs the same functions as the former button's macro, but additionally prints the pertinent scenarios' *'Mailflow Model'* and *'Mailflow Model Costs'* worksheets. This enables the user to print each and every scenario's mailflow for the selected class and subclass.

When entering an individual scenario on the *'Control Sheet,'* the user will find the corresponding modeled unit volume variable cost on the *'Mailflow Model Costs'* worksheet.

2. *'Cost Averaging'* Worksheet

This worksheet calculates weighted-average costs by rate category and isolated barcode-related savings for the specified *'Control Sheet'* class and subclass. These calculations rely upon the unit volume variable costs on the *'Scenario Costs'* worksheet.

3. *'Scenario Costs'* Worksheet

This worksheet develops the CRA-adjusted unit volume variable costs for the specified *'Control Sheet'* input. The aforementioned macros populate the modeled unit volume variable costs.

4. *'Mailflow Model'* Worksheet

This worksheet is a graphical representation of a scenario's mailflow across bundle and piece handling activities.

5. *'Mailflow Model Costs'* Worksheet

This worksheet develops a scenario's total modeled cost per piece that is the sum of the modeled bundle distribution cost per piece and the modeled piece distribution cost per piece.

6. *'Mailflow Model Costs Footnotes'* Worksheet

This worksheet presents footnotes for the *'Mailflow Model Costs'* worksheet.

7. *'Scenario Data'* Worksheet

This worksheet performs calculations upon input data and provides data employed by the *'Mailflow Model'* worksheet. There is one row of data for every scenario. The scenario determines which data are used. Table IV-1 presents worksheet data examples.

**TABLE IV-1: 'SCENARIO DATA' EXAMPLES**

- Number of bundles entering the MADC container activity.
- Percentage of bundles that downflow from the 3D container activity to piece distribution.
- Number of pieces that downflow from the ADC container activity to IP piece distribution.
- Percentage of pieces that downflow from the ADC container activity to IP piece distribution that flow to the FSM 881 BCR/OCR activity.
- Number of rejects that flow from the FSM 881 BCR/OCR OP to the FSM Keying OP (calculated as part of the total number of pieces flowing to the FSM Keying OP).

8. *'Scenario Data Footnotes'* Worksheet

This worksheet presents footnotes for the *'Scenario Data'* worksheet.

9. *'Data'* Worksheet

This worksheet stores modeling input data.

10. *'Coverage Factors'* Worksheet

This worksheet stores originating and destinating coverage factors.

11. *'CapacitySOP Factors'* Worksheet

This worksheet stores originating and destinating capacity/SOP factors.

12. *'Downflows – Bundle'* Worksheet

This worksheet stores bundle downflow densities.

13. *'Downflows – Piece'* Worksheet

This worksheet stores piece downflow densities.

14. *'Productivities'* Worksheet

This worksheet stores productivities and volume variability factors.

15. *'Accept Rates'* Worksheet

This worksheet stores accept rates.

16. *'CRA Cost Pools'* Worksheet

This worksheet stores CRA costs and determines worksharing-related and not worksharing-related CRA costs.

17. *'Vols-First'* Worksheet

This worksheet calculates First-Class Mail volumes by worksharing attribute and element combinations.

18. *'Vols-Per Reg'* Worksheet

This worksheet calculates Periodicals Regular volumes by worksharing attribute and element combinations.

19. *'Vols-Per Non'* Worksheet

This worksheet calculates Periodicals Nonprofit volumes by worksharing attribute and element combinations.

20. *'Vols-Std (A) Reg'* Worksheet

This worksheet calculates Standard Mail (A) Regular volumes by worksharing attribute and element combinations.

21. *'Vols-Std (A) Non'* Worksheet

This worksheet calculates Standard Mail (A) Nonprofit volumes by worksharing attribute and element combinations.

## I. MODEL MISCELLANY

The following list describes various modeling considerations.

1. The model flows rejects according to table IV-2. These flows are estimates from Operations.

2. The model does not apply coverage or capacity/SOP factors to rejects. This is due to model simplification.

3. The model does not model costs for carrier route flats on MADC containers. This is due to model simplification and an expected immaterial cost impact.

**TABLE IV-2: REJECT FLOW**

| |
|---|
| • AFSM 100 barcoded rejects → 50% FSM 1000 keying, 50% manual |
| • AFSM 100 nonbarcoded rejects → 50% FSM 1000 keying, 50% manual |
| • FSM 881 barcoded rejects → 50% FSM 881 keying, 50% FSM 1000 keying |
| • FSM 881 nonbarcoded rejects → 50% FSM 881 keying, 50% FSM 1000 keying |
| • FSM 881 keying rejects → 100% FSM 1000 keying |
| • FSM 1000 barcoded rejects → 80% FSM 1000 keying, 20% manual |
| • FSM 1000 nonbarcoded rejects → 100% manual |

4. The model considers nonbarcoded, carrier route flats on ADC, 3D, and 5D containers to have representative mailflows and costs as the corresponding barcoded mailstreams. This is due to mail processing activities handling barcoded, carrier route pieces from bundles that prematurely lose bundle integrity in a manner similar to nonbarcoded pieces.

5. The model considers all CR containers to have only nonbarcoded, nonmachinable flats. This is due to the mail processing cost not varying with respect to barcoding or machinability.

6. The model does not differentiate sacks from pallets in determining modeled *costs*. The analysis does differentiate sacked *volumes* from palletized *volumes* in order to weight costs into rate category average costs.

7. The model applies coverage and capacity/SOP factors when flats first enter originating and destinating piece handling activities. Before applying the destinating coverage and capacity/SOP factors, the model separately aggregates flats from both AFSM 100 and FSM 881 activities and from FSM 1000 activities. Hence, the model reallocates flats flowing from both AFSM 100 and FSM 881 activities and from FSM 1000 activities to destinating

activities. Appendix A illustrates how the model combines coverage and capacity/SOP factors to allocate flats.

8. The model uses witness Seckar's piece downflow densities from USPS LR-H-134 which originated in USPS LR-MCR-3. The FSM 881 keying density extends to each of the following activities: FSM 881 OCR, FSM 881 keying, AFSM 100 BCR/OCR/VCS, AFSM 100 OCR/VCS, and FSM 1000 keying. The FSM 881 BCR density extends to each of the following activities: FSM 881 BCR and FSM 1000 BCR. The manual density extends to manual activities.

   The AFSM 100 can have 120 bins, 20 bins more than the FSM 881 and FSM 1000. The model extends the historical densities, however, to AFSM 100 activities due to the lack of necessary and sufficient AFSM 100 density data.

9. The model equates mechanized bundle downflow densities with manual bundle downflow densities. This is due to the lack of necessary and sufficient manual bundle downflow density data.

## V. WEIGHTED-AVERAGE COSTS BY RATE CATEGORY

This testimony calculates weighted-average costs by rate category and designates them "*cost averages - actual.*" These costs are the average costs of the average flats that qualify for the rate categories. This approach is comparable to witness Seckar's actual mail makeup method in Docket No. R97-1.

These *cost averages - actual* figures determine the average mail processing volume variable unit cost for a given rate category and the presortation-related cost difference for a given flat. Subtracting one weighted-average cost from another when holding automation or nonautomation constant calculates the presortation-related cost difference.

The *cost averages - actual* do not necessarily enable one to calculate barcode-related cost savings. In witness Moden's Docket No. R97-1 testimony (USPS-T-4 at 11-12), he referred to a peculiar output from the flats' cost models, where barcoded flats appeared to cost more than nonbarcoded flats. This is due to averaging.

The average flat of a nonbarcoded rate category may have different container presortation, package presortation, and machinability attributes than the average flat of the corresponding barcoded rate category. For example, consider a hypothetical average basic, nonbarcoded flat to be a 3-digit, machinable flat in an ADC sack and a hypothetical average basic, barcoded flat to be an ADC, nonmachinable flat on an ADC pallet. A difference of the basic rate categories' weighted-average costs would consider a cost effect due to variable presortation and machinability. This accordingly does not isolate barcode-related cost savings and may indeed result in peculiar outputs.

## VI. ISOLATED BARCODE-RELATED COST SAVINGS

The model calculates a second set of weighted-average costs by rate category and designates them "*cost averages - normalized auto-related savings.*" The differences of these cost averages when holding the presort category constant are the isolated barcode-related cost savings. This testimony isolates the savings by holding container presortation, package presortation, and machinability constant.

For example, this approach contrasts the modeled cost of a nonbarcoded, MADC, machinable flat in a MADC container to the modeled cost of a barcoded, MADC, machinable flat in a MADC container. The resulting difference is the mail processing costs avoided due to the presence of a barcode. The model calculates a difference for most combinations of container presortation, package presortation, and machinability.

The model excluded the following combinations:[9]

- Nonbarcoded, 3-digit flats in ADC and MADC sacks.
- Barcoded, 3-digit flats in ADC and MADC sacks.
- Nonbarcoded, 5-digit flats in ADC and MADC sacks.
- Barcoded, 5-digit flats in ADC and MADC sacks.
- Nonbarcoded, 5-digit Periodicals in 3-digit sacks.
- Barcoded, 5-digit Periodicals in 3-digit sacks.

The model excluded these flats because the analysis isolated barcode-related cost saving relationships between each nonautomation *rate category* and its corresponding automation *rate category.* Hence, these relationships are between, for example, the basic, nonautomation rate category and the basic, automation rate category.

[9] The model also did not consider certain First-Class flats due to the nonexistence of 3-digit and 5-digit nonautomation rate categories.

The excluded flats do not have such rate category relationships. For example, nonbarcoded, 3-digit Standard Mail (A) flats in ADC and MADC sacks qualify for the basic, nonautomation rate. The analogous barcoded, 3-digit Standard Mail (A) flats in ADC and MADC sacks qualify for the 3/5-digit, automation rate. The rate category relationship in this example is between the basic, nonautomation rate category and the 3/5-digit, automation rate category.

Excluding these flats results in isolated barcode-related cost savings that can be used for pricing purposes.

The model uses both barcoded and nonbarcoded volumes in calculating each *cost averages - normalized auto-related savings* weighted average. This approach recognizes the expected barcode-related cost savings from barcoded flats and the potential barcode-related cost savings from nonbarcoded flats. The differences of the cost averages, therefore, include cost-based signals of the costs avoided by barcoded flats due to their barcodes and the costs that would be avoided by nonbarcoded flats if they had barcodes.

This approach also ensures that the differences of the weighted-average costs equal the averages of the differences.[10]

[10] There are two obvious approaches to perform the calculations. The first approach is to calculate the average, barcoded flat cost and the average, nonbarcoded flat cost and then take the difference. This is the difference of the weighted-average costs. The second approach is to calculate the barcode to nonbarcode cost difference for each combination of container presortation, package presortation, and machinability. Then, the approach uses the respective volumes to calculate the weighted-average cost difference. This is the average of the differences.

# APPENDIX A
# APPLICATION OF COVERAGE AND CAPACITY/SOP FACTORS

The ensuing flow charts illustrate how the cost modeling methodology combines coverage and capacity/SOP factors to allocate flats to mail processing activities. There is a chart for each of the following:

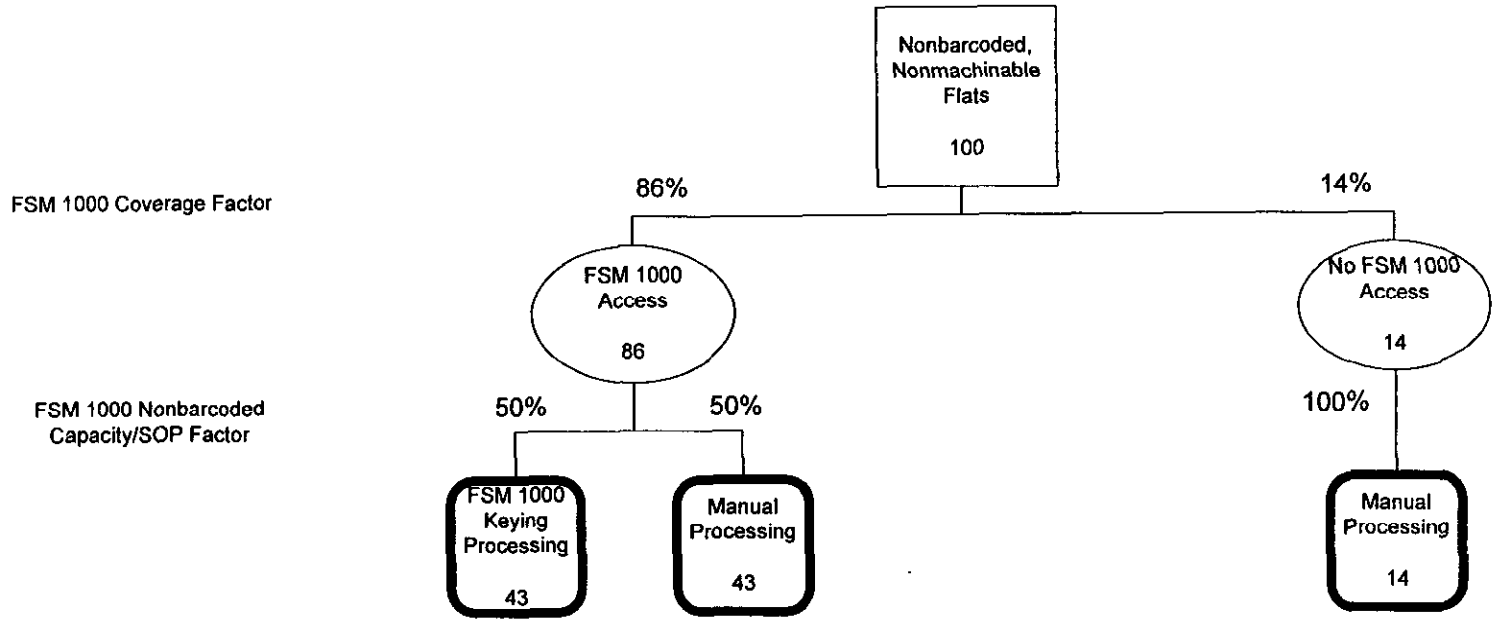
- nonbarcoded, nonmachinable flats
- barcoded, nonmachinable flats
- nonbarcoded, machinable flats
- barcoded, machinable flats.

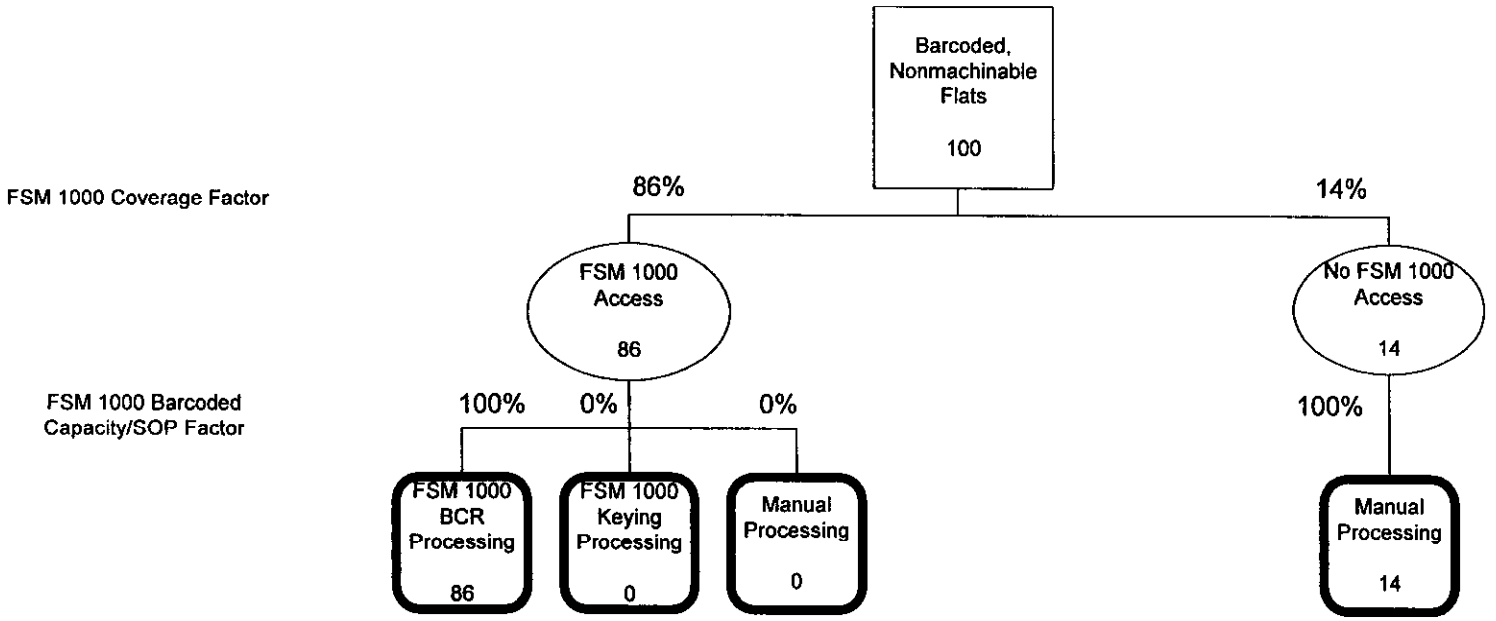
This testimony discusses the nonbarcoded, nonmachinable flats flow chart. The square box at the top has 100 nonbarcoded, nonmachinable flats. The approach first applies the *FSM 1000 coverage factor* to those 100 flats. 86 of the 100 flats originate or destinate to facilities that have FSM 1000s. 14 of the 100 flats do not originate or destinate to facilities that have FSM 1000s. The chart depicts these figures in oval boxes as having "access" or "no access."

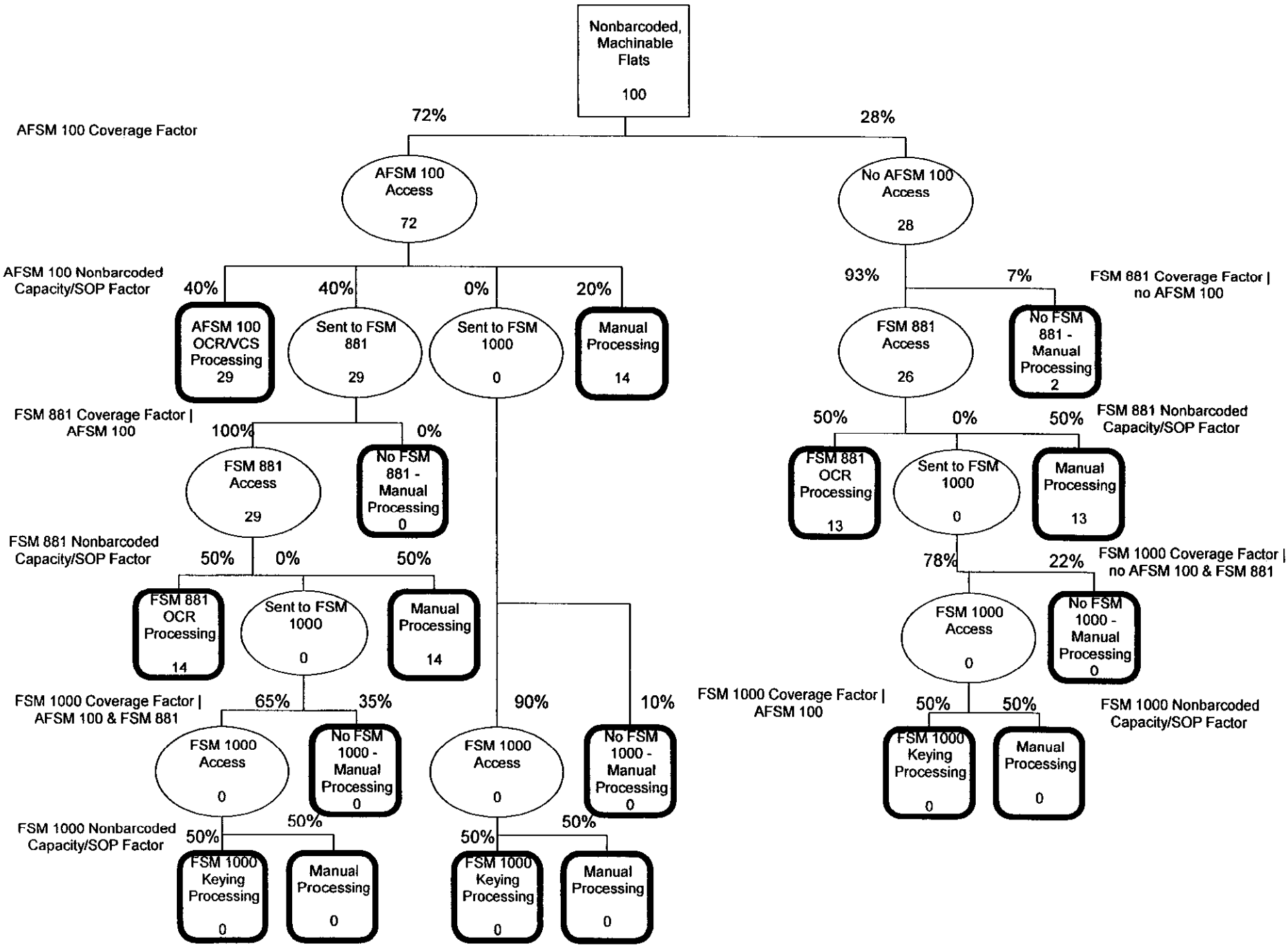
The approach then applies the *FSM 1000 nonbarcoded capacity/SOP factor* to the 86 flats. Of the 86 flats, 43 flow to the FSM 1000 keying activity and 43 flow to manual processing. The chart depicts these figures in bolded, square boxes with rounded edges.

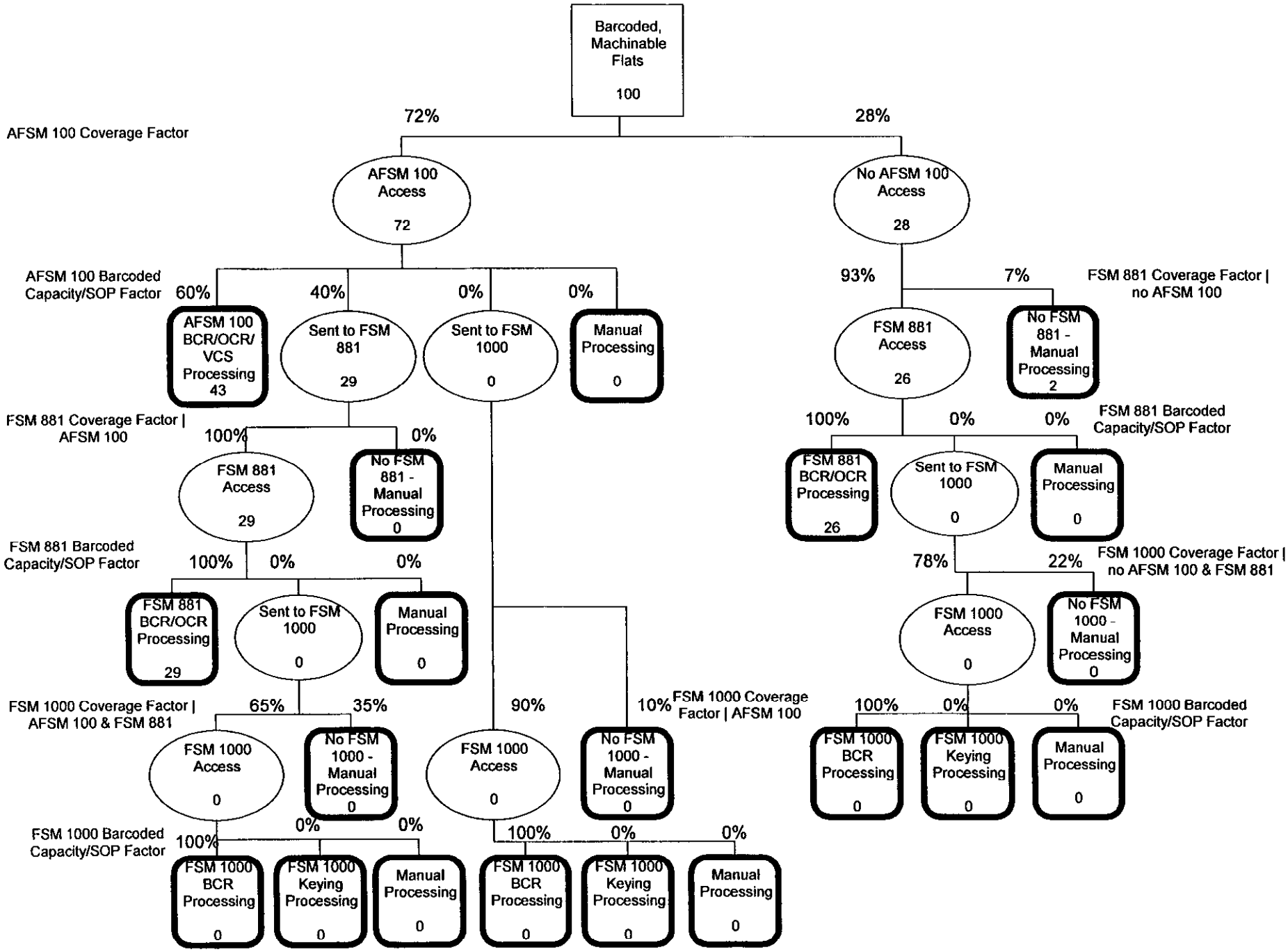
Of the 14 flats that do not have FSM 1000 access, all 14 flow to manual processing. The chart depicts this figure in a bolded, square box with rounded edges.

The overall approach allocates 43 percent of nonbarcoded, nonmachinable flats to the FSM 1000 keying activity and 57 percent to manual processing.


Nonbarcoded, Nonmachinable Flats
100
FSM 1000 Coverage Factor
86%
14%
FSM 1000 Access
86
No FSM 1000 Access
14
FSM 1000 Nonbarcoded Capacity/SOP Factor
50%
50%
100%
FSM 1000 Keying Processing
43
Manual Processing
43
Manual Processing
14


Barcoded, Nonmachinable Flats
100
FSM 1000 Coverage Factor
86%
14%
FSM 1000 Access
86
No FSM 1000 Access
14
FSM 1000 Barcoded Capacity/SOP Factor
100%
0%
0%
100%
FSM 1000 BCR Processing
86
FSM 1000 Keying Processing
0
Manual Processing
0
Manual Processing
14


Nonbarcoded, Machinable Flats
100
AFSM 100 Coverage Factor
72%
28%
AFSM 100 Access
72
No AFSM 100 Access
28
AFSM 100 Nonbarcoded Capacity/SOP Factor
40%
40%
0%
20%
AFSM 100 OCR/VCS Processing
29
Sent to FSM 881
29
Sent to FSM 1000
0
Manual Processing
14
93%
7%
FSM 881 Coverage Factor | no AFSM 100
FSM 881 Access
26
No FSM 881 - Manual Processing
2
FSM 881 Coverage Factor | AFSM 100
100%
0%
FSM 881 Access
29
No FSM 881 - Manual Processing
0
50%
0%
50%
FSM 881 Nonbarcoded Capacity/SOP Factor
FSM 881 OCR Processing
13
Sent to FSM 1000
0
Manual Processing
13
FSM 881 Nonbarcoded Capacity/SOP Factor
50%
0%
50%
FSM 881 OCR Processing
14
Sent to FSM 1000
0
Manual Processing
14
78%
22%
FSM 1000 Coverage Factor | no AFSM 100 & FSM 881
FSM 1000 Access
0
No FSM 1000 - Manual Processing
0
FSM 1000 Coverage Factor | AFSM 100 & FSM 881
65%
35%
90%
10%
FSM 1000 Coverage Factor | AFSM 100
50%
50%
FSM 1000 Nonbarcoded Capacity/SOP Factor
FSM 1000 Access
0
No FSM 1000 - Manual Processing
0
FSM 1000 Access
0
No FSM 1000 - Manual Processing
0
FSM 1000 Keying Processing
0
Manual Processing
0
FSM 1000 Nonbarcoded Capacity/SOP Factor
50%
50%
50%
50%
FSM 1000 Keying Processing
0
Manual Processing
0
FSM 1000 Keying Processing
0
Manual Processing
0


Barcoded, Machinable Flats 100
AFSM 100 Coverage Factor
72%
28%
AFSM 100 Access 72
No AFSM 100 Access 28
AFSM 100 Barcoded Capacity/SOP Factor
60%
40%
0%
0%
AFSM 100 BCR/OCR/ VCS Processing 43
Sent to FSM 881 29
Sent to FSM 1000 0
Manual Processing 0
93%
7%
FSM 881 Coverage Factor | no AFSM 100
FSM 881 Access 26
No FSM 881 - Manual Processing 2
FSM 881 Coverage Factor | AFSM 100
100%
0%
FSM 881 Access 29
No FSM 881 - Manual Processing 0
100%
0%
0%
FSM 881 Barcoded Capacity/SOP Factor
FSM 881 BCR/OCR Processing 26
Sent to FSM 1000 0
Manual Processing 0
FSM 881 Barcoded Capacity/SOP Factor
100%
0%
0%
FSM 881 BCR/OCR Processing 29
Sent to FSM 1000 0
Manual Processing 0
78%
22%
FSM 1000 Coverage Factor | no AFSM 100 & FSM 881
FSM 1000 Access 0
No FSM 1000 - Manual Processing 0
FSM 1000 Coverage Factor | AFSM 100 & FSM 881
65%
35%
90%
10%
FSM 1000 Coverage Factor | AFSM 100
FSM 1000 Access 0
No FSM 1000 - Manual Processing 0
FSM 1000 Access 0
No FSM 1000 - Manual Processing 0
100%
0%
0%
FSM 1000 Barcoded Capacity/SOP Factor
FSM 1000 BCR Processing 0
FSM 1000 Keying Processing 0
Manual Processing 0
FSM 1000 Barcoded Capacity/SOP Factor
100%
0%
0%
FSM 1000 BCR Processing 0
FSM 1000 Keying Processing 0
Manual Processing 0
100%
0%
0%
FSM 1000 BCR Processing 0
FSM 1000 Keying Processing 0
Manual Processing 0